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veloping—a matter made so explicit that the phrase is coined to express it—it is strictly the *knower's point of view* from which such a dualism is depicted. I aim to trace the natural history of the naïve dualism of knowledge inside the consciousness that has it. My motive in saying this here is not so much to meet this criticism as the wish to explain an ambiguous phrase I have employed in the book. I speak of 'foreign control' as of something 'foreign to the process itself' (of knowledge). What I mean is '*seeming to the process itself to be foreign*,' not '*seeming to the writer to be foreign to or apart from the process*.' There is a real ambiguity in the phrase, and I am herewith calling attention to it. Others may be misled by it.

Dr. Tawney also says that many of the 'objects' I distinguish are not such from the knower's point of view; implying that by using that phrase I limit the 'knower's logic' to process having a self-conscious knower, that is, to consciousness of *the self-knowing or reflective type*. On the contrary, I use 'knower' for any process that has knowledge, as is customary; the dog, the worm, the mollusc is a 'knower' so far as it knows anything; indeed, I have gone to excessive pains to say that I treat of cognitive meanings from the point of view of *the process that has them—the psychic point of view*. How and with what *psychic meaning* there arise objects of knowledge in a progressive series, it is the main problem of my book to discuss. It begs the whole question to assume that there is no knowledge except that which *knows the self*. With the conclusions one may differ, but the doctrine should be clearly expounded.

Finally, a word in ethics. It is a writer's duty sometimes to help the critic understand his views; for a real embarrassment may arise to one who fears to criticize, lest the criticism, though possibly due to misinterpretation, may yet seem to misrepresent and so to have upon it the taint of intellectual dishonesty. I myself have sometimes felt in studying a book that if I knew the writer's own real mind to be or not to be what I take it to be, I should feel more free in criticizing him; for, of course, if a critic does know better, misrepresentation is

dishonest. So though in itself a point be hardly important enough to require attention, yet the author may have the duty of aiding those who take interest in his work.

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February 3, 1907

#### SPECIAL ARTICLES

##### SYMMETRY IN BIG CLAWS OF THE LOBSTER

THE lobster is probably the most widely known of living crustacea, as it is one of the largest, and most eagerly sought for food. Few who have seen it have failed to notice that the great 'forceps' or big claws are unlike, the larger, which weighs from one quarter to one half as much as the entire animal, having crushing tubercles, while the smaller and slenderer is armed with tooth-like spines. The toothed, or 'quick,' claw, which is a 'lock-forceps' with serrate jaws, is used for seizing and holding, and the larger crushing, or 'club,' claw for rending and crushing the prey.

The large claws occur about as frequently upon the right as upon the left side of the body, and without distinction of sex, but as I have shown to be the case with the shrimp *Alpheus*, in which the asymmetry and inequality of the great chelæ are even more marked, this condition is probably one of direct inheritance, all members of a brood being either right-handed or left-handed. That is to say, the normal position of the toothed or crushing claw is not haphazard, but is predetermined in the egg.

In 1895 I described a variation in the American lobster<sup>1</sup> (*Homarus americanus*) in which both the big chelæ were similar, and of the toothed type. This variation was exceedingly rare, only three cases having been found in a collection of 2,430 lobsters made by Mr. Vinal N. Edwards, the naturalist and collector of the U. S. Fisheries' laboratory at Woods Hole, Massachusetts.

Since that time several papers have appeared upon this subject, notably by Stahr,<sup>2</sup>

<sup>1</sup> 'The American Lobster,' Bull. U. S. Fish Comm., 1895, p. 143.

<sup>2</sup> *Jenaischen Zeitschrift f. Naturwiss.*, 33 Bd., 1898.

who found this variation of similar toothed claws much more common in the European lobster. The history of development proves, as Stahr upon theoretical grounds maintained, that the toothed claw represents the more primitive, and the crushing claw the more modified, type. It, therefore, seemed natural to infer, as he did, that the anomalous symmetry in these weapons had been brought about by loss of a crushing claw, and subsequent reversion to the primitive toothed condition in the regenerated member which took its place. This would give us a lobster with symmetrical toothed claws like the variation described.

The converse of this, or the production of a new crushing claw in place of a toothed 'forceps' could not occur upon Stahr's theory of regeneration, and hence he inferred that my report of a case of *similar crushing* claws in a lobster was an error. Herr Stahr is not to be blamed, for this report was based upon the statement of a fisherman. Yet, however great the unreliability of this class of men in biological matters, I have yet to find a 'lobsterman' who could not tell a 'club' from a 'quick' claw. It now seems that the maligned fisherman was right, and he should get his dues, while Herr Stahr's theory will have to be revised, for Dr. W. T. Calman, of the British Museum, has recently described<sup>3</sup> a case of symmetrical crushing claws in the British lobster (*Homarus gammarus*), and his account is accompanied by an excellent photograph. In all other respects this animal was a perfectly normal male. It was caught near Stromness, Orkney, and its living weight was four pounds ten ounces.

In a letter regarding this unique specimen Dr. Calman says:

The correspondence between the two chelæ as regards arrangement and size of the crushing tubercles is even closer than appears on the photograph, where slight differences of color have a little obscured the shape in one or two points. The differences are no greater than one would expect to find between the two sides of a normally symmetrical animal. In other respects the chelipeds are practically alike in size and shape,

<sup>3</sup>In *Proceedings of the Zoological Society of London* for 1906.

except that, as seen on the figure, the dactylus of the left is shorter than that of the right. The basal segments of the limbs show no trace of asymmetry which is often associated with regeneration.

The shrimp *Alpheus* carries a huge 'hammer,' or snapping, claw, which in some species is as large as the entire body of the animal, and a diminutive claw of more primitive form on the opposite side. Moreover, in the common *Alpheus heterochelis* of the southern coast the small chela presents an interesting sexual variation of which I have drawings and notes made in 1893, but about which nothing had been published until the appearance of Wilson's interesting studies on the 'Reversal of Asymmetry in *Alpheus*' in 1903. The small chela of the male resembles the 'hammer' more closely than does the corresponding simpler and more primitive claw of the female.

A remarkable example of heteromorphic regeneration or reversal of asymmetry is seen when the *Alpheus* 'shoots' its 'hammer,' or for any cause loses its big claw, as was discovered by Prizibram in 1891. The big claw seems to hold the little one in check, for no sooner is it lost than the smaller one grows apace, and becomes differentiated into a 'hammer' or a 'snapper,' while in compensation for this change a diminutive chela of the primitive type replaces the great claw lost from the opposite side. Wilson found that in both sexes the small claw, which was regenerated from the stump of the large one, was always of the simpler female type, and, moreover, that the small chela of the male was more rapidly changed into the big 'pistol' or 'hammer' claw because it was already farther advanced on this line of development than that of the female. When the smaller claw is amputated, or when the 'forceps' are removed from both sides of the body at once, there is no reversal, a new cutting chela or hammer claw taking the place of the corresponding member lost. Many additional facts have been brought to light through the experimental studies of Wilson, Brues and Zeleny.

In the lobster no reversal or compensatory regulation normally or usually attends the re-

generation of any of its appendages. The crushing or the toothed forceps, when severed at the 'breaking plane,' are replaced by their like in due time after one or more molts. How, then, are we to explain the anomaly of similar claws? It seems highly probable that the reversal, which regularly takes place in *Alpheus* when its great 'hammer' claw is cut off, does actually occur, though but rarely, in the lobster, or rather that it involves one side only, there being no immediate compensatory change to restore equilibrium of the system of which the great claws form a part. Thus, when a 'club' claw is 'shot' or amputated by the experimenter, a chela of similar crushing type is usually regenerated in its stead, but rarely a toothed claw appears. There is a reversal of the appendage, bringing about an abnormal condition of symmetry, but the process stops here, and we have as the result lobsters with similar toothed claws, like the specimen illustrated in my earlier work referred to above.

In like fashion the toothed claw of the lobster is usually replaced in regeneration by a limb of similar type, as is the rule with *Alpheus*, but in rare cases a reversal occurs here also; a 'club' claw appears, and we get a lobster with symmetrical crushing chelæ, like the specimen described by Dr. Calman. As this case is, for the present, essentially unique in the literature of the subject, we may be sure that it is much rarer than reversal from crushing to toothed claws. There is the possibility that these abnormal conditions of symmetry may be upset by a compensatory change in the appendage of the opposite side, but there is no evidence at present that this ever takes place.

In the first case the reversal from crushing to toothed claw happens to reproduce the primitive form of limb, but we see no reason for regarding this as a case of reversion to an ancestral stage, in the sense in which Stahr uses the phrase.

The explanation just offered is based on the assumption that regeneration, following loss, actually occurs in these cases. If there has been no regeneration, we must then fall back upon the view that as asymmetry in the great

forceps is normally produced by changes which take place in the egg, so the rare condition of symmetry in these appendages may be casually brought about in the same way.

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#### CURRENT NOTES ON METEOROLOGY

##### THE WEATHER OF SAXONY

THAT portion of the *Deutsches Meteorologisches Jahrbuch* for 1902 which relates to the kingdom of Saxony (Dresden, 1906) contains a discussion of the special observations made at the meteorological stations in that section with a view to furnishing information regarding the general weather conditions, for use in forecasting. In addition to the regular observations made thrice daily, the observers note the prevailing type of weather during the morning, afternoon and evening, according to a scale of ten. These types differ somewhat in summer and in winter. They are simple; are noted by means of symbols, and have been found to serve very well in giving the forecaster an excellent general view of the prevailing weather over the kingdom. Such a scheme might well be adopted among the volunteer observers in this country and elsewhere, and would often serve to give a clearer idea of the weather conditions than do the regular meteorological observations taken twice a day. A second paper, on the dependence of weather in Saxony on the prevailing weather conditions of Europe, will be found useful in detailed studies of European climatology.

##### RAILROAD BUILDING IN ARID REGIONS

THE climatic difficulties now being met with in the construction of the new railroad between Damascus and Mecca are naturally similar to those previously encountered in other arid regions. The main line is being built across a desert highland where for hundreds of miles there are no permanent human settlements within thirty to fifty miles of the track. The country from Damascus to Medina is inhabited only by small bands of nomadic Bedouins. The scarcity of water is giving serious trouble. Some new artesian wells